Route to:

Return to:

INSTITUTE OF GAS TECHNOLOGY

THE GAS INDUSTRY'S OWN EDUCATIONAL AND RESEARCH FACILITY

CHICAGO 16, ILLINOIS

GAS ABSTRACTS

VOLUME 8, NUMBER 2

FEBRUARY, 1952

AFFILIATED WITH

ILLINOIS INSTITUTE OF TECHNOLOGY

CONTENTS

1. Gas Industry 21
2. Appliances 22
3. Combustion and Industrial Furnaces 22
4. Carbonization and Gasification 23
5. Natural Gas and Natural Gs Condenstes 26
6. Petroleum nd Synthetic Liquid Fuels 31
7. Analytical Methods and Tests 33
8. General and Physical Chemistry 34
9. Organic Chemistry 38
10. Chemical Engineering 40
11. Process Equipment and Instrumentation 42
12. Materials of Construction 43
13. New Books 44

GAS ABSTRACTS is published and distributed monthly by the Institute of Gas Technology, Chicago 16, Illinois. The contents of selected papers and patents are reviewed impartially by the editorial staff and material of potential interest to the Gas Industry is presented. Subscription rates to non-members of the Institute: $15.00 per year.—Printed in the U.S.A.

Copyright 1952 by the Institute of Gas Technology.

A special microfilm edition of Gas Abstracts can be supplied by University Microfilms, 313 N. First St., Ann Arbor, Michigan.

1. GAS INDUSTRY

Canadian Oil and Gas

ACTIVITY IN WESTERN CANADA SOARS TO HIGHEST PEAK IN DOMINION'S HISTORY. *Oil Gas J.* **50**, 264-69 (1951) December 20.

Exploration and development work in western Canada are at the highest level in the history of Canada. Since the beginning of 1951 there have been 18 discoveries of oil in Alberta and several elsewhere. Considerable quantities of gas have also been found. 150 geophysical crews and 215 rigs are currently at work, principally in Alberta. Of greatest interest is the Devonian coral reef. J. D. Parent

Fire Protection

Civil Defense Liaison Office. FIRE EFFECTS OF BOMBING ATTACKS. NSRB. Doc. 132 (1950) November. Reprint (1951) August.

An analysis of the effect of fire bombing on German and Japanese cities is given. Building density, combustibility of structures, firebreaks and target areas of enemy and American cities are compared. Conclusions are drawn on the similar susceptibility of American cities to fire bombing and suggestions are made for improving the fire defenses of the nation.

W. G. Bair

Gas Price Increase

HIGHER MINIMUM PRICE ASKED FOR GUYMON-HUGOTON FIELD. *Oil Gas J.* **50**, 134 (1952) January 14.

The Oklahoma State Corporation Commission will hold hearings on an application by royalty owners in the Guymon-Hugoton Gas Field, Texas Co. for an approximate 3 cent jump in the well-head price of gas.

J. D. Parent

Gas Supply Regulation

Rather, C. P. PAD'S GAS BRANCH. *Gas* **27**, 48, 49, 51 (1951) December.

In addition to presenting the organization and operation of the Petroleum Administration for Defense, the author makes two pointed observations: 1) the gas industry is becoming more and more a part of the oil industry, with about 60% of all gas consumers using straight natural gas, while a majority of the remainder uses gas derived in part from natural gas, oil, propane or butane, all of which are petroleum products; 2) in the event of emergency, it is possible that some operators will be called on to give up part of their supplies to another company serving an essential user, although this step will not be taken without study of whether the necessary defense product can be manufactured by a similar industry on another gas system in a better position to supply the required gas.

A. E. Neumann

Serif, M. NATURAL GAS RESTRICTIONS—WHO WIELDS THE BIG STICK? *Gas Age* **108**, 40, 41, 77-79 (1951) December 6.

The present status of the PAD order preventing extension of natural gas service is reviewed. The original order bans all extensions of natural gas for large volume users unless the supply is fully interruptible. It also bans, with certain exceptions, acceptance of new house heating customers. The Bow Amendment passed last July greatly watered down the order, which was ultimately applied only in the northeastern section of the country. Here it is only necessary to have the state public service commission certify to the President that it is using controls consistent with the objectives of the DPA to eliminate the restrictive control of the PAD. Currently only New York and the District of Columbia have elected to comply with the order, while seven states have rejected it and seven are still undecided. J. D. Parent

House Heating

HALF A LOAD IS BETTER THAN NONE. *Gas Heat* **2**, 30-32, 38 (1951) December.

The restrictions on gas heating are losing many customers for gas utilities. A satisfactory solution has been found in the St. Louis area. Dual-fuel heating can sustain dealers' volume, protect utility load and keep other appliances from competition. Under this system the customer signs a yearly contract to switch to the auxillary fuel when outside temperatures decrease below an agreed figure. As soon as a firm gas supply is available these customers are changed to straight gas. D. L. Nicol

2. APPLIANCES

Burner

Furczyk, A. A. (assigned to Selas Corp. of America) INTERNALLY FIRED GAS BURNER WITH RADIANT END WALL. U.S. 2,575,514 (1951) November 20.

A premixed combustible gas-air mixture is burned in a hollow refractory body which forms the combustion space. This space is terminated at its outlet end by a slotted discharge orifice. This refractory wall is heated to incandescence (2700-2900°F). In heating application the work is preheated by the incandescent heat and final temperatures are produced from hot discharge gases. B. G. Lang

Safety Cut-Off

Durrell, L. F. GAS HEATER DEVICE. U.S. 2,574,173 (1951) November 6.

A safety device for cut-off of small open-fire room heaters is described. The device has a three-fold actuation of cut-off, by the thermostat on the stove, line pressure of the gas and automatic timer. This device is readily portable and is mounted on the gas line to the stove.

D. L. Nicol

Utilization – Water Heating

Reynolds, T. W. MEASURES TO AVOID TROUBLES IN DOMESTIC HOT WATER SYSTEMS. Part II. *Heating & Ventilating* 48, 78-82 (1951) November.

Part II contains a series of simple diagrams of piping layouts with a discussion of faulty conditions and the steps that should be taken to correct them. [*See Gas Abs.* 7, 271 (1951) December] . B. G. Lang

3. COMBUSTION AND INDUSTRIAL FURNACES

Air Pollution

Phillips, G. AN ELECTRONIC METHOD OF DETECTING IMPURITIES IN THE AIR. *J. Sci. Instruments* (British) 28, 342-347 (1951) November.

Impurity concentrations in clean dry air of one part in 10^7 by weight of polar vapors or of one part in 10^4 by weight of non-polar vapors were measured in terms of changes in surface potential of a prepared plate. Changes of potential of the order of 10 microvolts were measured using a vibrating condenser technique and a selective phase-sensitive amplifier. The possibilities of obtaining selective adsorption and some of the practical applications are discussed briefly. Author's Abstract

Sawyer, F. G. AIR POLLUTION. *Ind. Eng. Chem.* 43, 2687-2693 (1951) December.

The causes of air pollution in the far West are discussed. Remedial measures have proven successful in many cases. Some legislative controls have been established in California. The need of research on air pollution causes and remedies, and industry cooperation is stressed.

C. E. Hummel

Coal Fired Turbines

Hurley, T. F. THE DESIGN OF COMBUSTION CHAMBERS FOR THE COAL-FIRED GAS TURBINE. *J. Inst. Petroleum* 37, 517-534 (1951) September.

A review is given on radiant-type air heaters, air-film cooled, slurry fired, and refractory-lined combustion chambers for burning pulverized solid fuels. Pressure combustion chambers suitable for application in a coal-fired gas turbine are still in the experimental stage but several improved designs have been tested, as for example (1) film-cooled metal chamber of the Locomotive Development Committee (2) water-coal slurry fired combustor of Westinghouse Co. (3) slagging type straight-through combustion chamber of Locomotive Development Committee (4) vortex combustor of the U.S. Bur. Mines and (5) cyclone combustor of the BCURA.

C. von Fredersdorff

Combustion Control

NEW AIR METER FOR COMBUSTION CONTROL. *Power Eng.* 55, 80-81 (1951) December.

This meter consists of one main airfoil section with two auxiliary airfoils just ahead of it. The restriction produced by the airfoil accelerates the air flow around the main airfoil and produces a differential head. This differential provides a measurement and a control impulse. The meter causes very small fan-power loss. Com-

plete details are given for design and construction of the meter. B. G. Lang

Combustion Research

Spalding, D. B. COMBUSTION OF FUEL PARTICLES. *Fuel* (British) **30**, 121-30 (1951) June.

The combustion of small particles of oil and carbon is considered. The variation of thermal conductivity with temperature may increase the combustion rate of oil droplets by two- or three-fold. Dissociation of the products of carbon combustion has the effect of doubling the combustion rate by forming a zone of carbon monoxide in combustion about the particle. A comparable effect does not occur with oil droplets. Oil droplets burn about 13 times as fast as carbon particles, and the time of burning of a fuel particle is roughly proportional to its initial surface area. S. Katz

Gas Reduction of Ore

Benedict, M., Wagstaff, J. B. and Webb, G. B. (assigned to Hydrocarbon Research Inc.) IRON OXIDE REDUCTION. U.S. 2,577,730 (1951) December 11.

Iron oxide is reduced by a counter-current stream of carbon monoxide and hydrogen gases while descending through a shaft furnace. The fresh reducing gases with a molar ratio of CO/H_2 of 0.5 to 2.5 are produced by partial combustion of natural gas, petroleum, tar or coal with oxygen of 50 to 90% purity and are adjusted to a CO/H_2 molar ratio of 1.2 to 4.0 by admixing at 1700° F with gases withdrawn from the shaft furnace at an intermediate point. The water content of the withdrawn gases is first eliminated by condensation, so that the water-gas shift reaction occurs.

O. P. Brysch

Gas Turbine

Dawson, J. G. SOME CONSIDERATIONS ON THE COMBUSTION IN GAS TURBINES. *J. Inst. Petroleum* (British) **37**, 509-516 (1951) September.

The relation between the combustion-chamber design and the performance of fuels is discussed.

D. L. Nicol

Putz, T. J. PROGRESS REPORT—BALDWIN-WESTINGHOUSE GAS-TURBINE ELECTRIC LOCOMOTIVE. *Power Eng.* **55**, 70, 113-118 (1951) November.

This is a report on operational tests of the Baldwin-Westinghouse 4000-hp gas-turbine locomotive which was placed in road operation in May, 1950, burning distillate fuel oil. Following the road operations a series of special tests were conducted firing one gas turbine unit with various grades of residual oils. Results showed that selected grades of residual oil can be burned successfully but a longer period of road operation is required before comparisons can be made with other types of motive power.

E. J. Pyrcioch

Steam-Coal Properties

MacDonald, E. J. THE INFLUENCE OF COAL CHARACTERISTICS ON THE PERFORMANCE OF STATIONARY BOILERS. *Bull. Brit. Coal Utilization Research Assoc.* **15**, 353-362 (1951) October.

The more recent publications on research studies of coal characteristics which affect the performance of boilers are reviewed in groups under the headings: (1) moisture, (2) fuel size, (3) ash, (4) volatile matter. A discussion of 80 references is given. O. P. Brysch

4. CARBONIZATION AND GASIFICATION

Annual Report: Coal Research

Fieldner, A. C. and Gottley, S. ANNUAL REPORT OF RESEARCH AND TECHNOLOGIC WORK ON COAL, FISCAL YEAR 1950. U.S. Bur. Miines Inf. Circ. **7618** (1951) November.

This is the Bureau's 15th resume of various scientific activities on coal, and covers the fiscal year 1950. Considerable work was reported on the survey of minable coking coal reserves, and on washing, blending and carbonizing studies of various coals for making metallurgical coke. The second underground gasification experiment at Gorgas, Ala., dealing chiefly with design of outlets and seals, and selection of sites and operating processes is reviewed. Mechanical mining practices on bituminous coal, design and tests of new mining machinery in an-

thracite mines, underground diesel engines, roof-bolting in mines, refrigerated ventilation, electric detonation and dust control are treated. Coal drying, briquetting and combustion are reported. Production and purification of synthesis gas on laboratory and pilot plant scale is reviewed. The production of synthetic liquid fuels on laboratory and pilot scale by the Fischer Tropsch and the hydrogenation methods, and cost studies are presented. O. P. Brysch

Beehive Coke Properties

Dudderar, F. A. INVESTIGATION DISCLOSES IMPROVEMENT IN BEEHIVE COKE. *Steel* 129, 98, 101, 104, 106 (1951) November 26.

Several observations could be made from a study of beehive coke of 9 U.S. Steel Co. plants. Using ash, sulfur, screen analysis and the Clairton drum degradation test: (1) great variation was noticed, even in the same plant; (2) 48-hour coke was generally better than 96-hour coke in strength and ash content; (3) Clairton byproduct coke showed better size, in plus 2-inch, than coke from 6 beehive plants on the same coal; (4) the beehive coke showed higher "fuel values" (tumbler) than the byproduct coke. Reasons for the variability are discussed.

O. P. Brysch

Coal Expansion Tests

Naugle, B. W., Davis, J. D., and Wilson, J. E. PRECISION OF EXPANSION TESTS ON COAL. *Ind. Eng. Chem.* 43, 2916-2922 (1951) December.

The authors present data on precision of expansion tests on coal based on 440 sole-heated oven tests and 36 vertical expansion oven tests. Correlations of groups of tests are given showing relation of expansion to coal particle size, d.m.m.f. fixed carbon, calculated expansion of constituents of 20% and 30% low-volatile blends and Gieseler plasticity, and of wall pressure with internal gas pressure. High correlation coefficients (0.85 to 0.95) were found. The data are useful in selection of coking coals as they indicate the reproducibility of tests and reliability of the relationships.

O. P. Brysch

Spooner, C. E. SWELLING POWER OF COAL. *Fuel* (British) 30, 193-202 (1951) September.

A general relationship is deduced showing that the swelling power of coal is directly proportional to the tar produced on thermal decomposition and inversely proportional to the amount of porous structure of the coal. This has been reduced to the general statement: swelling is proportional to

$$(\text{hydrogen} - 4.2) / (\text{oxygen})^2.$$

This relation is shown to apply and equations are deduced for swelling tests with fast and slow rates of heating such as the B.S. swelling test, the Gray-King coke type and the Sheffield Laboratory coking test. These formulae are then applied in conjunction with the volatile matter to the deduction of the calorific value, ultimate analysis and other properties of coals.

Author's Abstract

Coal Structure

Breger, I. A. CHEMICAL AND STRUCTURAL RELATIONSHIP OF LIGNIN TO HUMIC SUBSTANCES. *Fuel* (British) 30, 204-208 (1951) September.

A critical study of coal evolution from organic material points to the probability that the cellulose is fairly completely broken down shortly after deposition of the plant substance, but that the lignin metamorphoses into the humic constituent of the coal. S. Katz

Mukherjee, P. N., Basak, N. G. and Lahiri, A. CHEMISORPTION OF MOISTURE ON COAL. *Fuel* (British) 30, 215-216 (1951) September.

Sorption-desorption isotherms of water vapor on a high-moisture Indian coal at several temperatures indicate that altho water sorption is mainly physical, there is also a chemisorption factor which increases with temperature.

O. P. Brysch

Zwietering, P., Oele, A. P. and Van Krevelen, D. W. PORE STRUCTURE AND INTERNAL SURFACE OF COAL. *Fuel* (British) 30, 203-204 (1951) September.

The results of an investigation of the porosity and the internal surface of different coals are reported. The values for the internal surface

of coal, determined from the adsorption of nitrogen at — 196° C, confirm the results of P. le R. Malherbe and show, that the "heat of wetting method" gives results many times too high. The values for the specific volume of the coal in helium are in agreement with the relationship of R. A. Franklin. The provisional results of an investigation of the change of the internal surface during carbonization are given.

Authors' Abstract

Coke Cost Accounting

Knuff, W. B. COKE OVEN COST ANALYSIS. *Blast Furnace & Steel Plant* 39, 1477-89, 1491 (1951) December.

The author describes the methods used to obtain uniformity in cost accounting in all plants of his company. The coke costs are credited with the value of the ammonia, crude tar, light oil and surplus gas in relation to the weight of these products in a ton of coal. Preparation of production data, oven by-product and benzol department costs, man-hour reports, repairs and supplies costs and interplant comparative cost sheets are described and their value to operators and management are discussed.

O. P. Brysch

Coke-Oven Door

Lavely, P. H. (assigned to Koppers Co., Inc.) COKE OVEN DOOR HANDLING APPARATUS. U.S. 2,576,126 (1951) November 27.

An apparatus for handling a coke-oven door is described, with the door supporting and positioning members moving independently of the door-latching member by means of separate hydraulically operated cylinders.

O. P. Brysch

Complete Gasification

Parry, V. F. METHOD FOR CONDUCTING AN ENDOTHERMIC CHEMICAL REACTION INVOLVING BOTH GASEOUS AND SOLID FEED MATERIALS. U.S. 2,572,051 (1951) October 23.

This invention relates particularly to processes for the continuous production of synthesis gas and fuel gas from non-caking carbonaceous materials in a vertical, externally heated, metallic annular retort. The solid materials (subbituminous coals, lignites, oil shales) descend by gravity in the annular space, and react with steam as their temperature increases. The gases are removed from the interior of the annular reaction zone and discharged from the top, while the solids descend to a second lower zone and are further gasified with air. The annular gas-fired heating system is provided with heat recuperators and temperatures are controlled by thermocouples in the reaction zones. Modifications of the apparatus are useful for direct reduction of iron and magnesium ores.

O. P. Brysch

A NEW COAL PROCESSING SYSTEM, OF INTEREST TO CANADIANS. *Can. Gas J.* 44, 318-20 (1951) November.

This is a condensed description of the "Ultra" process, furnished by the Ultra Carbonization Corp. of Canada, Ltd., Toronto, Ontario, and based upon the experimental work of the Anglo-American Carbonizing Corp., Ltd., London. The method consists in passing highly superheated steam successively through four large static charges of coal, each controlled within a definite temperature range and all interconnected by five gas mains. In each charge, one of the four more or less isolated phases of coal gasification occurs, (1) dehydration, (2) low-temperature carbonization, (3) high temperature carbonization, (4) water gas reaction. Steam, superheated in a regenerator by combustion of part of the product gas, first enters the coke bed (at 2400°F) of phase (4). The water gas produced therein serves as the direct heating medium for phases (3) and (2). Rich gas from the carbonization phase (3) is cracked in phase (4) and also used for enrichment. Such successive utilization of sensible heat is claimed to give 93% thermal efficiency. Gas at a cost of 6 cents per therm is claimed for Canadian coals.

O. P. Brysch

COS Properties

Partington, J. R. and Neville, H. H. ORTHOBARIC DENSITIES AND SURFACE TENSION OF CARBONYL SULFIDE. *J. Phys. and Colloid Chem.* 55, 1550-1557 (1951) December.

These fundamental properties of carbonyl sulfide (one of the predominant organic sulfur con-

stituents of manufactured gases) have been determined over a wide range of temperatures. The critical point was found to be

102.2° C. ± 0.2°.

C. E. Hummel

Modern Carbonizing Plants

MODERN COKING PLANTS IN SOUTH AFRICA. *Coke and Gas* (British) **13**, 377-384 (1951) November.

Since the first South African installation of 57 W-D Becker coke ovens at Pretoria in 1934, the South African Iron and Steel Industrial Corp., Ltd. (Iscor) has enlarged this plant to 166 ovens (3074 tons coal/day), and has built a second plant (operating in late 1950) at Vanderbijl Park of 54 ovens (1151 tons coal/day). Each has a complete by-product recovery system, including tar and light oil refineries, and each is integrated with the iron and steel works.

O. P. Brysch

NEW COKE OVEN PLANT AT FISHBURN. *Gas World* (British) **134**, 533 (1951) December 8.

Piling is complete and pad construction under way for a 50-oven plant of W-D Becker ovens for the National Coal Board at Fishburn, Durham. About 1000 tons coal will be used each day. This plant will replace the local 30-year old plant and another 40-year old plant at Thrislington. The Northern Gas Board will be supplied with the gas.

O. P. Brysch

Oil Gas Research

Chafin, K. and Corrigan, T. E. HOW MUCH HEAT IS REQUIRED TO CRACK KEROSENE AND NO. 2 FUEL OIL. *Gas Age* **108**, 19-25 (1951) December 20.

The heat requirements for the cracking process used in the manufacture of carbureted water gas was investigated and the results are presented in graphical form. The cracking of oil into a gas was found to be an endothermic reaction requiring 8000 to 12,000 Btu per gallon of feed. This was found to vary with the temperature at which cracking takes place, the time of contact, and the composition of the feed stock. Heat requirements were measured at various temperatures and contact times and at two feed stock compositions. The feed stock compositions tested were kerosene and a Number 2 fuel oil. The heat requirements varied from 8000 to 12,000 Btu per gallon of kerosene and from 7000 to 13,000 Btu per gallon of fuel oil. The amount of gas made per gallon of feed varied from 40 to 116 cu ft for kerosene and from 38 to 96 cu ft for fuel oil. Over the range of this investigation the amount of gas made was found to be proportional to the heat input per gallon of feed.

Authors' Abstract

Sulfur Recovery

Burden, F. A. and Newling, W. B. RECOVERY OF PURE SULFUR FROM SPENT OXIDE. Inst. Gas Engrs. Publ. No. **397**: *Gas World* (British) **134**, 571-573 (1951) December 22: 608-611, December 29: *Gas Times* (British) **69**, 499-501 (1951) December 28: *Gas J.* (British) **269**, 115-121 (1952) January 9.

Spent oxide which has been dried is extracted with toluene at 100° to 110°C. Pure sulfur crystals are formed by slow cooling of the hot extract solution during agitation. The mother liquor containing tars is drained off and the sulfur is rapidly washed with cold toluene. Fusion of the sulfur crystals permits recovery of a product sufficiently pure for use in a contact sulfuric acid plant.

C. E. Hummel

5. NATURAL GAS AND NATURAL GAS CONDENSATES

Carbon Black Production

Colby, D. S., Barton, H. J. and Oppegard, B. E. CARBON BLACK. Preprint, U.S. Bur. Mines Minerals Yearbook 1950.

Production of carbon black in U.S. increased 13% to 1.4 billion pounds in 1950. Sales increased more rapidly than production. Furnace black production increased 28% while contact black decreased 2%. The quantity of natural gas used by the industry decreased slightly to 411 MMMcf while the use of liquid hydrocarbons increased by nearly one half to 108 million gallons. Average price was 6.12¢ per lb. The price of furnace blacks rose while that of channel blacks was almost unchanged. The yield per Mcf of gas was 1.75 lbs by the contact

process, but 7.56 by the furnace process. It was 3.02 lbs per gallon of liquid hydrocarbon. 53 plants were in operation—35 contact and 18 furnace type. J. D. Parent

Gardner, D. (assigned to J. E. Hughes, New York) PRODUCTION OF CARBON BY ELECTRICAL DISCHARGE. U.S. 2,572,851 (1951) October 30.

An apparatus for the production of a very low density and small particle size carbon black is described. The carbon black is formed from hydrocarbon gases by means of an electrical discharge. D. V. Kniebes

Carbon Black Properties

Pierce, C., Smith, R. H., Wiley, J. W. and Cordes, H. ADSORPTION OF WATER BY CARBON. *J. Am. Chem. Soc.* 73, 4551-4557 (1951) October.

Water isotherms are used to detect capillaries in certain carbon blacks. These isotherms are given for porous and non-porous carbons. F. T. Perry

Cleaning Pipelines

Reed, P. PIPE-LINE SCRAPER TRAPS FOR CRUDE AND PRODUCTS LINES. *Oil Gas J.* 50, 56-59 (1951) December 27.

Scraper traps and piping details, including barrel dimension, by-pass lines, and valve installations, are discussed. D. C. Gami

Stephens, D. K. (assigned to Panhandle Eastern Pipe Line Co.) FLUID MEDIUM PROPELLED AND ROTATED APPARATUS FOR CLEANING THE INSIDE OF PIPES. U.S. 2,576,197 (1951) November 27.

A device, of "go-devil" type, is claimed for the cleaning of the inside of pipes. It comprises a tubular body, one end closed, fitted with circumferential wire-brushes and "squee-gee" bands, propelled and rotated by the pressure of the gas. Part of the gas pressure is used to eject the loosened dirt and scale ahead of the device. O. P. Brysch

Gas Main Economics

Lutz, W. J. and Miller, J. H. DOLLAR ECONOMICS OF GAS MAIN SIZING. *Am. Gas J.* 175, 16-17, 47 (1951) November. *Gas* 27, 38-40 (1951) December: *Am. Gas Assoc. Monthly* 34, 13-14 (1952) January.

Realizing that the engineering calculation of the correct pipe size for a given installation is only the first step, the authors on the basis of the present worth of future annual charges have presented a method of determining whether to use a certain size or the next larger size. Following certain assumptions it is shown that for mains having a cost ratio of 2 to 3 and a capacity ratio of 1 to 2 the larger main need handle only 50% capacity any time prior to 20 years. For mains having a cost ratio of 3 to 5 and a capacity ratio of 1 to 3, the larger main need handle only 33⅓% capacity any time prior to 12 years, and for mains having a cost ratio of 3 to 4 and a capacity ratio of 1 to 3 the larger main need handle only 33⅓% capacity at any time prior to 28 years. B. E. Hunt

Gas Separation

Berg, C. H. (assigned to Union Oil Co. of California) ADSORPTION PROCESS. U.S. 2,575,520 (1951) November 20.

A method for the separation of gaseous mixtures into their component parts by means of continuous selective adsorption on activated charcoal is claimed. W. J. Pleticka

Imhoff, D. H. and Berg, C. H. (assigned to Union Oil Co.) ADSORPTION PROCESS. U.S. 2,575,519 (1951) November 20.

It is claimed that a mixture of gases, particularly hydrogen, carbon monoxide, and carbon dioxide, can be passed over a moving stream of charcoal at a pressure over 50 lb psi with the removal of the non-hydrogen gases. W. J. Pleticka

Leak Detection

Campbell, E. G. WHY PLANNED PROGRAM OF LEAK DETECTION PAYS CONTINUING DIVIDENDS. *Gas Age* 108, 26-28, 56-59, (1951) December 20.

Various types of leak-detecting equipment are described. The instruction program for train-

ing classes in the use of the combustible gas indicator is discussed. Various types of surveys —vegetation, manhole, barhole, and public building—are discussed. The use of the Chicago leak detector and the gas main scope for pinpointing leaks are described.

B. E. Hunt

LP-Gas Distribution

Craddock, R. B. LPG IN PARADISE—HAWAIIAN ISLANDS. *Butane-Propane* 13, 34-41 (1951) December.

Butane is blended with crude oil and shipped to Hawaii. There it is refined by Pacific Refiners, Ltd., yielding butane, gas oil, and road asphalt. The extracted LPG is distributed under the trade name of "ISLE-GAS," to 2000 customers on 5 islands. The gas oil is used for oil gas manufacture by the Honolulu Gas Co. for city distribution. Hilo Gas Co., a subsidiary, was converted to a butane-air plant.

B. Lang

LP-Gas Handling

Sweeney, R. J. HOW TO TRANSFER VOLATILE LIQUIDS UNDER PRESSURE. *Chem. Eng.* 58, 158-161 (1951) November.

The article deals with the various ways of transfering volatile liquids under pressure, i.e. liquid pumping with and without vapor lines, and vapor pumping with compressors. Advantages and disadvantages are discussed and limitations on each system presented.

H. A. Dirksen

REPORT ON LP-GAS SUPPLY AND TRANSPORTATION. *LP-Gas* 11, 66 (1951) December.

The article is a summary of the report issued October 31, 1951 by the National Petroleum Council's Committee on Liquefied Petroleum Gas Availability, Transportation and Materials Requirements. The availability of LP-Gas is presented by recent production figures of propane, butane and mixtures. Following is a survey of transportation facilities.

R. A. Brown

STORAGE AND TRANSPORTATION OF LP-GAS. *LP-Gas* 11, 44-49 (1951) December.

The methods of transporting LP-Gas by tank cars, trucks, tankers, barges, and pipe lines and the storage of LP-Gas in steel tank and underground are discussed. Expansion of storage facilities by producers, development of summer load to balance winter and summer demand, and larger consumer storage to reduce fuel deliveries in winter are among the items suggested for solving LP-Gas storage and transportation problems.

D. C. Gami

LP-Gas Recovery

WHEN USE RICH-OIL RECTIFICATION. *Oil Gas J.* 50, 109 (1952) January 14.

Stripping rich oil in a dual still offers economics over the single still, but rich oil deethanization should be considered whenever propane recovery is to exceed about 50%. Some plant operating data are given.

J. D. Parent

LP-Gas Underground Storage

NATURAL GASOLINE. CAVERN COMPLETED CITIES SERVICE'S LOWELL PROJECT STORING PROPANE. *Oil Gas J.* 50, 101 (1951) December 27.

An underground cavern has been leached out of a massive salt deposit near Lowell, Michigan, for storage of propane by Cities Service Gas Co. The deposit is nearly 4,000 feet deep and capacity is 4,000,000 gal. 1,000,000 gal are being stored this winter. Injection pressure was 1,200 psi. Withdrawal rate is 200 gal/min and will be achieved by injecting water down the tubing and removing propane through the annular space.

J. D. Parent

Pipe Flow Calculations

Hull, J. T. SIMPLIFIED GAS PIPE LINE CALCULATIONS. *World Oil* 134, 207-209 (1952) January.

Charts are presented as an aid to the calculation of the Reynolds number for gases having gravities of 0.60, 0.65 and 0.70.

O. T. Bloomer

Poettmann, F. H. THE CALCULATION OF PRESSURE DROP IN THE FLOW OF NATURAL GAS THROUGH PIPE. *J. Petroleum Technology* 3, 317-326 (1951) November; A.I.M.E. Tech. Pub. 3217.

An equation has been derived for use in cal-

culating the sandface pressure of flowing gas wells in which the variation of the compressibility factor of the gas with pressure is taken into consideration. This variation due to compressibility has been put into both graphical and tabular form. Comparison of calculated results with field-measured results were made on 20 dry-gas wells from a given field and 11 distillate wells from different fields. The agreement between calculated and observed results is good. In addition to their use in the calculation of sandface pressures of flowing wells, the factors can be used in the direct calculation of the static bottom hole pressure of gas wells, the capacity of gas transmission lines, and in the calculation of the theoretical isothermal horsepower necessary to compress a natural gas. Examples demonstrating the use of various equations are given. Author's Abstract

Voorwijk, J. F. COMPUTING GAS PIPE LINES. APPLICATION TO PIPE LINES OF AN IMPROVED METHOD OF REPRESENTING WIDE-RANGE SCALES IN ALIGNMENT DIAGRAM. *Petroleum Engr.* 23, D7-D10 (1951) December.

One of the common gas flow formulae in the form of the Spitzglass equation is treated in nomographic form for the rapid solution of gas transmission problems in horizontal pipelines. The flow-equation is treated in a novel manner so that the variable flow volume and the variable pipe length can cover an extreme range without affecting the accuracy of the nomograph.

C. von Fredersdorff

Production

Messer, E. S. INTERSTITIAL WATER DETERMINATION BY AN EVAPORATION METHOD. *J. Petroleum Technology* 3, 269-74 (1951) October.

Procedures for measuring the irreducible interstitial water in porous media such as soil structures are described. The present method consists of permitting the saturant in the pore spaces to evaporate until the irreducible volume remains. Water is a suitable fluid; however, results are usually obtained more rapidly with organic fluids such as benzene and carbon tetrachloride. S. Katz

Meyer, H. I. CRITIQUE OF PRESENT METHODS USED IN DETERMINING INTERSTITIAL WATER SATURATION. *Oil Gas J.* 50, 113-119 (1952) January 14.

Interstitial water saturation of reservoir rocks is defined and discussed, and means of measuring it are reviewed and evaluated briefly. A number of useful references are included.

J. D. Parent

P-V-T Relations

Eduljee, H. E., Newitt, D. M. and Weale, K. E. PRESSURE-VOLUME-TEMPERATURE RELATIONS IN LIQUIDS AND LIQUID MIXTURS. PART I. THE COMPRESSION OF n-HEXANE, n-HEPTANE, n-OCTANE, AND OF THEIR BINARY AND TERNARY MIXTURES, UP TO 5000 ATMOSPHERES. *J. Chem. Soc.* (British) 3086-3091 (1951) November.

The compression or fractional decrease in volume of n-hexane, n-heptane, n-octane and of binary and ternary mixtures of these hydrocarbons was determined up to 5000 atmospheres at temperatures of 0°, 25°, 40°, and 60°C.

O. T. Bloomer

Newitt, D. M. and Weale, K. E. PRESSURE-VOLUME-TEMPERATURE RELATIONS IN LIQUIDS AND LIQUID MIXTURES. PART II. THE COMPRESSION ISOTHERMS OF SOME ORGANIC LIQUIDS UP TO 1000 ATMOSPHERES, AND THE COMPRESSIONS OF SOME AQUEOUS AND NON-AQUEOUS BINARY LIQUID MIXTURES. *J. Chem. Soc.* (British) 3092-3098 (1951) November.

The compression or fractional decrease in volume of eight chlorine-substituted hydrocarbons, and of acetone, has been measured at 25° and at pressures up to 1000 atmospheres. The relation of this quantity to other properties of the liquids is discussed. The compression of a number of binary liquid mixtures at 25° and 1000 atmospheres has been measured over the whole composition range. Systems having water as one component show a compression minimum, which is related to other properties of these mixtures. Authors' Abstract

White, D., Friedman, A. S. and Johnston, H. L. THE CRITICAL TEMPERATURE AND CRITICAL PRESSURE OF NITROGEN. *J. Am. Chem. Soc.* **73**, 5713-5715 (1951) December.

The critical constants of nitrogen have been determined by observation of the disappearance of the meniscus. The critical temperature is 126.26 ± 0.04°K and the critical pressure is 33.54 ± 0.02 atm. These results are compared with earlier vapor pressure data and with the critical constants estimated by extrapolation of P-V-T data. Authors' Abstract

Sulfur Recovery

NEW SULFUR PROCESS ECONOMIC RECOVERY FROM GASES. *Natl. Gas Bull.* (Australia) **15**, 18-20 (1951) September-October.

The Australian "Ferralyst" catalytic oxidation process for conversion of inorganic and organic sulfur compounds to elemental sulfur or sulfur dioxide is reviewed. The successful applications of this process to the desulfurization of furnace atmospheres, gases used in the synthesis of liquid hydrocarbons, waste gases from the paper and smelting industries are described. Further applications of this process to recover sulfur in pure form from Girbitol H_2S effluents and coke oven gases are being studied.

C. E. Hummel

ROYALITE OIL COMPANY'S NEW SULFUR RECOVERY PLANT. *Heat Eng.* **24**, 183-91 (1951) November.

Waste gases from a Girbotol unit are to be utilized in producing 30 long tons of elemental sulfur per day. Operation of the plant, located near the Turner Valley, Alberta, plant of the Madison Natural Gas Company, is scheduled for April, 1952. C. E. Hummel

Thermodynamic Properties

Sledjeski, E. W. ISOBARIC HEAT CAPACITY OF METHANE. *Ind. Eng. Chem.* **43**, 2913-15 (1951) December.

Isobaric heat capacities for methane relative to that of an ideal gas (C_p-C_p^*) are presented in graphical form for pressures up to 10,000 psia and temperatures up to 1300°F. These values are calculated by the Benedict-Webb-Rubin equation of state. The author recommends the use of these values above 220°F and above 1500 psia.

D. C. Gami

Transmission Lines

GAS LINES OBTAIN PIPE ALLOCATIONS. 143,150 TONS GO TO THREE PROJECTS IN QUARTER. *Pipe Line News* **23**, 48 (1951) December.

Three major natural gas pipe line projects valued at over $250,000,000 have been given priorities for line pipe for the first quarter of 1952. In addition 361 smaller projects calling for less than 5000 tons each have been given priorities assistance.

J. D. Parent

TRANSCONTINENTAL GAS REVENUES FOR QUARTER. *Pipe Line News* **23**, 48 (1951) December.

Earnings of the Transcontinental line are briefly discussed. J. D. Parent

THE 16-INCH EASTERN CANADA'S BIGGEST GAS PIPE LINE, 61 MILES LONG, COMPLETED FROM WINDSOR TO DAWN. *Can Gas J.* **44**, 335-340 (1951) December.

A good description and collection of photographs on the construction of this line are given. This new line delivers 30 MMcf of gas per day into underground storage. Present export permits allow for summer deliveries only.

D. C. Gami

Underground Storage

Ralph, H. D. GAS REVOLUTION. *Oil Gas J.* **50**, 175-77 (1951) December 20.

Underground storage of natural gas is bringing about a significant change in the economics of the industry. Storage on either end of the line is of value, particularly for the production of such gas as must be produced with oil. This "distress" gas need not be flared or put to low grade uses if adequate storage is possible. Storage near the distribution end sufficient to handle 30% of a line's annual capacity will permit sales of 100% of the gas for highest-price uses. Requirements of storage structure, procurement, conditioning and maintenance are discussed.

J. D. Parent

6. PETROLEUM AND SYNTHETIC LIQUID FUELS

Auto-Thermic Cracking

Kinnaird, W. R. (assigned to Universal Oil Products Co.) AUTOTHERMIC CRACKING REACTOR. U.S. 2,576,228 (1951) November 27.

The patent claims an improved reactor for the partial combustion of a light hydrocarbon to produce fuel gas continuously (the autothermic cracking process.) H. R. Linden

Catalysis, with Sonic Aid

Smith, R. B. (assigned to Sinclair Refining Co.) CATALYTIC CONVERSION OF HYDROCARBONS WITH FINELY DIVIDED CATALYSTS UTILIZING SONIC VIBRATIONS. U.S. 2,578,377 (1951) December 11.

The patent claims that by subjecting a single-pass catalytic reactor to sonic wave vibration of the travelling wave-type perpendicular to the longitudinal direction, the catalyst life and residence time is lengthened.

H. A. Dirksen

Catalysts

Deanesly, R. M. (assigned to Universal Oil Products Co.) PREPARATION OF FINE POWDERS FROM GEL MATERIALS. U.S. 2,572,321 (1951) October 23.

The patent claims a gel may be pulverized into a fine powder below 2 microns by passing the gel in a fluid stream from a high pressure to a lower pressure through a nozzle.

H. A. Dirksen

Garner, W. E. CATALYSTS AND SOLID REACTIONS. *Chem. & Ind.* (British) 47, 1010-1015 (1951) November 24.

The article consists mainly of a review of the work done previously on catalytic and solid reactions. H. A. Dirksen

Hoog, H. CHOICE AND DEVELOPMENT OF CATALYSTS IN INDUSTRIAL CHEMISTRY. *Chemistry & Industry* (British) 42, 872-877 (1951) October 20.

This article shows that selection of a catalyst for a new reaction by "intuition based on knowledge" is inadequate to meet industrial requirements. The article analyzes the technical requirements: activity, selectivity, life or regenerability and mechanical properties, and gives a survey of techniques used for obtaining a catalyst, support and promoter with desirable properties. H. A. Dirksen

McGrath, H. G. CATALYTIC UPGRADING BY HYDROFORMING. *Oil Gas J.* 50, 78-81 (1951) December 27.

The article presents the hydroforming reaction and pilot plant data on the operating variables for the fluid catalyst hydroformer. A cost analysis of the fluid hydroformer is also included.

H. A. Dirksen

Thomas, C. L. (assigned to Great Lakes Carbon Corp.) REMOVAL OF IRON FROM A CRACKING CATALYST. U.S. 2,576,653 (1951) November 27.

A method of removing iron from clay by means of chlorine or volatile chlorinated hydrocarbon at 300-700°C with subsequent removal of the carbon to produce a cracking catalyst with a long catalytic life is claimed.

W. J. Pleticka

CATALYSTS. *Chem. Eng.* 58, 157-168 (1951) December.

The article reports on the current methods used for the selection, manufacture and industrial applications of catalysts. Under selection of catalysts, the requirements a catalyst must meet are presented, i.e., activity, selectivity, lifetime and mechanical strength. Under manufacture of catalysts the support, size and shape are discussed. The manufacture of the various shapes, (pellets, spheres, powder, rings, granules) are presented in some detail. The recent applications discussed are synthetic detergents, resins, synthetic rubber, synthetic fibers and aromatics and aviation gases. H. A. Dirksen

Catalytic Cracking

Charlton, H. E. NEW PETROCHEMICALS PLANT PRODUCING FULL RANGE OF PRODUCTS FROM MIDDLE EAST NAPHTHA. *Oil Gas J.* 50, 201-203, 328 (1951) December 20.

The operation and products of Petrochemicals Ltd.'s plant near Manchester are described. The

tail gas from the Catarole vapor-phase cracking process is sold to the Partington gas works. At the present time the mixed C_4 fraction is used as LP-gas. W. J. Pleticka

Zabor, R. C. and Emmett, P. H. THE ADSORPTION OF NORMAL PARAFFINS ON CRACKING CATALYSTS. *J. Am. Chem. Soc.* 73, 5639-5643 (1951) December.

The results of an experimental study of the adsorption of n-butane, n-hexane, and n-octane on a Houdry S-46, silica-alumina cracking catalyst over the temperature range 40 to 530° are presented. Only a very small fraction of the catalyticc surface is covered with adsorbed saturated hydrocarbon in the temperature range of catalytic decomposition, indicating negligible chemisorption. The absence of any detectable chemisorption suggests that if the carbonium ion theory is to explain the cracking, then the slow step in the process must be the formation of the carbonium ion on the surface.

D. Werle

MICROSPHEROIDAL CRACKING CATALYST. *Chem Eng.* 58, 218-223 (1951) November.

The production of microspheroidal silica-alumina catalysts by the Davison plant in Cincinnati is presented in some detail. H. A. Dirksen

Desulfurization

Porter, F. W., Green, F. R., Docksey, P., Lorne, H. T., Northcott, R. P. (assigned to Anglo-Iranian Oil Co. Ltd., England) CATALYTIC DESULFURIZATION OF PETROLEUM PRODUCTS. U.S. 2,573,726; 2,574,445 to 2,574,451 (1951) November 6.

The above patents present a continuous process for the hydrocatalytic desulfurization of various sulfur and naphthene-containing hydrocarbons. The process is self supporting as far as hydrogen is concerned. The reaction takes place between 650 and 800° F, and 50-250 psig and at a space velocity of 0.5 to 5.0 v/v/hr using cobalt and molybdenum oxides on an alumina support for the catalyst. H. A. Dirksen

Fischer-Tropsch Synthesis

Belchetz, A. (assigned to M. W. Kellogg Co.) PREPARATION OF HYDROGEN-CARBON OXIDE MIXTURES AND CATALYTIC REACTION THEREOF. U.S. 2,577,563 (1951) December 4.

The patent claims a process by which methane is converted to CO + H_2, the CH_4 catalytically oxidized and the CO + H_2 converted to higher hydrocarbons. The reaction temperature is 1000° F to about 1700° F. The catalyst is then oxidized at 1200° F to 2000° F, returned for the oxidation of methane and the CO + H_2 reacted at 350° F to about 750° F. The reaction takes place between atmospheric and 500 psig.

H. A. Dirksen

Lanning, W. C. (assigned to Phillips Petroleum Co.) HYDROCARBON SYNTHESIS PROCESS. U.S. 2,573,795 (1951) November 6.

A method to regenerate a fluidized catalyst in the hydrocarbon synthesis process in the synthesis reactor is presented. A promoted iron-oxide catalyst is used for the synthesis reaction at 290 to 340° C. It is regenerated above the reaction zone in the presence of the hydrogen-rich gas at temperatures of 300 to 500° C.

H. A. Dirksen

Rubin, L. C. (assigned to M. W. Kellogg Co.) SYNTHESIS OF ORGANIC COMPOUNDS. U.S. 2,576,858 (1951) November 27.

The patent claims a method of reducing methane formation in the synthesis of hydrocarbons from CO + H_2. A fluidized bed is used along with a liquid, which is completely vaporizable at reaction conditions and which is injected into the fluidized bed. The heat is controlled and methane formation reduced.

H. A. Dirksen

Hydrogenation

Smith, W. (assigned to Standard Oil Development Co.) HYDROGENATION PROCESS. U.S. 2,574,355 (1951) November 6.

A method is presented of de-oxygenating a hydrocarbon synthesis product, (hydrogen and carbon monoxide) without hydrogenating olefins and aromatics, using hydrogen with the synthesis product at elevated temperatures (700° F) and pressures (100 psi) in the presence of a mixture of cobalt molybdate and molybdenum trioxide on activated alumina as a catalyst.

H. A. Dirksen

7. ANALYTICAL METHODS AND TESTS

Effluent Analysis

Shaw, J. A. DETERMINATION OF PHENOLS IN AQUEOUS WASTES FROM COKE PLANTS. *Anal. Chem.* 23, 1788-1792 (1951) December.

A method is described for determining very low (to 20 parts per billion) concentrations of phenols in aqueous wastes from coke plants. It can be applied to solutions too dilute to be tested by the bromine turbidimetric method, and depends upon colorimetric comparison of the unknown with known solutions, with 4-amino antipyrine. Data are given on the effects of various impurities, time of standing, pH of solutions, and amounts of reagents, upon the amount of phenol indicated. O. P. Brysch

Shaw, J. A. ESTIMATION OF OXYGEN-CONSUMING VALUE OF COKE-PLANT AQUEOUS WASTES. *Anal. Chem.* 23, 1764-1767 (1951) December.

The polluting effects of coke-plant aqueous wastes usually have been considered to vary with their oxygen demand or their reducing characteristics. The author describes a reasonably rapid and accurate plant control method for determining oxygen-consuming value. This depends on chromic acid oxidation for 12 minutes at 100° C in H_2SO_4 — H_3PO_4 solution. Data are given on the effects of heating, concentration, interfering substances and kind of phenol upon the oxygen consumed.

O. P. Brysch

Infrared Analysis

Evans, A. and Hibbard, R. R. DETERMINATION OF CARBON-HYDROGEN GROUPS IN HIGH MOLECULAR-WEIGHT HYDROCARBONS BY NEAR-INFRARED ABSORPTION. *Anal. Chem.* 23, 1604-1610 (1951) November.

The absorption spectra of high molecular weight hydrocarbons (C_{13} to C_{34}) were studied in the near-infrared region. The methyl, methylene, and aromatic CH groups present were determined quite accurately. The method is applicable to such products as lubricating oils, paraffin wax, and polystyrene. J. M. Errington

Liquid Hydrocarbon Analysis

Wadley, E. F. and Anderson, J. A., Jr. (assigned to Standard Oil Development Co.) METHOD FOR ANALYZING HYDROCARBONS. U.S. 2,577,640 (1951) December 4.

A method of determining the conjugated diene content of liquid hydrocarbons is described. It combines absorption spectrophotometry with chemical methods to obtain a diene index which is a measure of the conjugated diene content.

D. V. Kniebes

Moisture in Gases

Politziner, I., Townsend, F. M. and Reid, L. S. MEASURING THE WATER VAPOR CONTENT OF GASES DEHYDRATED BY TRIETHYLENE GLYCOL. *J. Petroleum Technology* 3, 301-304 (1951) November: A. I. M. E. *Tech. Pub.* 3200.

Recently published data indicate that the water-vapor content of a gas, as determined by dew point measurement is inaccurate when the gas has been dehydrated with *diethylene glycol.* Water vapor contents and dew point measurements of gases dehydrated with *triethylene glycol* have been obtained in this investigation in order to determine the magnitude of a similar error, if one exists. Experimental data show a very low concentration of triethylene glycol vapor in gases dehydrated at atmospheric temperatures and pressures ranging from 500 to 2500 psia, and that the accuracy of dew point measurements is not impaired by the presence of triethylene glycol vapor. Authors' Abstract

Nitrate Determination

Dalen, Van, E. SCHNELLE BESTIMMUNG VON NITRAT IN LOSUNG MITTELS KATALYTISCHER REDUKTION MIT WASSERSTOFF. (RAPID DETERMINATION OF NITRATE IN SOLUTIONS BY CATALYTIC REDUCTION WITH HYDROGEN.) *Analytica Chimica Acta*, 5, 463-71 (in German) (1951) October.

Nitrogen present as nitrate in solution is determined by catalytic reduction to ammonia. A stream of hydrogen passes through the alkaline solution containing the samples and Raney nickel, and transports ammonia to a receiver where it is collected and titrated. Various ions did not interfere although cadmium and lead caused low results. C. H. Riesz

Spectrometric Analysis

Robinson, C. F. PROCESS CONTROL BY MASS SPECTROMETER. *Chem. Eng.* 58, 136-137 (1951) December.

A continuous and precise analysis of small amounts of ethane in the presence of other hydrocarbons was furnished by a mass-spectrometer type gas analyser. The instrument requires little maintenance and has a self-calibration feature. D. V. Kniebes

The following articles, the abstracts for which appear on the pages indicated, are also called to your attention:

Griffith, R. H. MAGNETIC OXYGEN RECORDER FOR AUTOMATIC CONTROL OF CATALYTIC PURIFICATION. p. 43

Messer, E. S. INTERSTITIAL WATER DETERMINATION BY AN EVAPORATION METHOD. p. 29

Meyer, H. I. CRITIQUE OF PRESENT METHODS USED IN DETERMINING INTERSTITIAL WATER SATURATION. p. 29

Pfund, A. H. MANOMETRIC GAS DETECTOR. p. 42

Phillips, G. AN ELECTRONIC METHOD OF DETECTING IMPURITIES IN THE AIR. p. 22

8. GENERAL AND PHYSICAL CHEMISTRY

Electron Microscopy

Sharpe, J. W. THE ELECTRON MICROSCOPE AND ITS INDUSTRIAL APPLICATION. *Chem. Ind.* (British) 46, 976-987 (1951) November 17.

This article is a survey of the industrial applications of the electron microscope. It discusses applications of the microscope in metallurgy, discoveries made through its use in the biological field, chemical microscopy, the use of the instrument in oil analysis, microscopic examination of industrial greases and soaps, work with carbon black in rubber manufacture, and work in the textile industry, and the pigment and paint industries. The electron microscope itself is also explained, and new developments in specimen preparation and shadow-casting are discussed. F. T. Perry

Equation of State

Benson, S. W. and Golding, R. A. A REDUCED EQUATION OF STATE FOR GASES AND LIQUIDS. *J. Chem. Physics* 19, 1413-1415 (1951) November.

An empirical, reduced equation of state has been derived for use with both liquids and gases. Two arbitrary constants are employed in addition to R. Comparisons of predicted liquid densities, vapor pressures, heats of vaporization, gas isotherms, thermal expansion and compressibility are examined. In general the equation appears somewhat superior to the van der Waals and Berthelot equations. S. Katz

Flame Research

Hornbeck, G. A. and Herman, R. C. HYDROCARBON FLAME SPECTRA. *Ind. Eng. Chem.* 43, 2739-2755 (1951) December.

Hydrocarbon flame spectra have been surveyed in the range of approx. 2000 to 9000 A. in order to establish the identity of band systems obtained under a variety of flame conditions. The sources and techniques required to enhance the spectra of specific molecular species by means of variations in oxygen-fuel ratio are described. The experimental results are presented chiefly in a selected series of densitometer tracings of bands obtained under a wide variety of oxygen-fuel ratios. The spectra of diatomic and polyatomic molecules, particularly the "hydrocarbon" and "deuterocarbon" flame bands, are discussed and some comments are made concerning the kinetic mechanisms involved. Several electronic ($2\Sigma - 2\Pi$) OH bands are reported. The results of this work are significant principally in that they provide the spectroscopic investigator of flames with a pictorial means of rapid identification. This was made possible by the fact that this survey was carried out at fairly high dispersion and with systematic variations of the oxygen-fuel ratio which enhanced specific molecular bands and made their identification relatively simple. Authors' Abstract

Laidler, K. J. and Shuler, K. E. KINETICS OF COMBUSTION. RELATION TO EMISSION FLAME SPECTROSCOPY. *Ind. Eng. Chem.* 43, 2758-2761 (1951) December.

This work was undertaken to indicate the utility and the limitations of the spectroscopic study of

flames in the elucidation of combustion processes and to acquaint the workers in the general field of combustion chemistry with some of the results obtained from these studies. For certain reaction systems, such as the carbon monoxide flame, these spectroscopic investigations have yielded sufficient information to permit a more detailed discussion of the combustion mechanism. In general, however, the present information is too meager to permit such an analysis and much more work, both theoretical and experimental, must be done in the kinetic spectroscopy of flames before it will be possible to obtain a more detailed insight into the mechanism of most combustion reactions. The results obtained so far from the spectroscopic study of flames indicate that here is a very powerful tool for the investigation of combustion kinetics. Authors' Abstract

Thomas, J. R. and Crandall, H. W. PREFLAME COMBUSTION OF HYDROCARBONS. SPECTROSCOPIC STUDIES OF REACTION INTERMEDIATES. *Ind. Eng. Chem.* **43**, 2761-2763 (1951) December.

The work described was initiated to obtain a better understanding of the reactions occurring during the preflame combustion of hydrocarbons. A recording ultraviolet spectrophotometer was employed for kinetic studies. The time dependence of the optical density was measured using light of varying wave lengths. It was found that the rate of formation of formaldehyde gradually increased during the induction period and that there was rapid production of formaldehyde during the cool flame. Compounds absorbing at 2050 A. were also formed autocatalytically during the induction period and were produced extremely rapidly in the cool flame. The intermediates which give rise to the 2600 A. absorption peak and referred to by Ubbelohde as compound X were identified as β-dicarbonyl compounds. These materials are consumed during the cool flame. A considerable fraction of the oxidized hydrocarbon may go through a β-dicarbonyl structure at some time during its oxidation and such compounds may be critical materials in cool flame formation from many hydrocarbons. The tendencies of several possible intermediates to produce β-dicarbonyls were measured. It was established that a simple aldehyde or ketone does not contribute to β-dicarbonyl formation. A mechanism to explain β-dicarbonyl formation is proposed which involves no molecular intermediates. This mechanism explains the fact that cyclopentane does not form any β-dicarbonyl compound during its preflame reactions. Authors' Abstract

OBSERVATION OF COOL FLAMES WITH ETHYLENE. *Nature* (British) **168**, 474-475 (1951) September 15.

Spontaneous ignition of ethylene/oxygen/nitrogen mixtures, when the mixture was fed into a pressure bomb at 300° C and pressures up to 40 atm., was found to give rise to two quite different types of flame. The cool flame produced as much as 20-28% of the oxygen consumed as formaldehyde. D. L. Nicol

Fluid Flow in Pores

Penner, S. E. and Robertson, A. F. FLOW THROUGH FABRIC-LIKE STRUCTURES. *Textile Research J.* **21**, 775-788 (1951) November.

A method is presented for the visual investigation of flow through fabrics. The fabric pores are considered as orifices, and the effect of weave structure on the fluid flow is investigated in the range of Reynold's numbers 10 to 400. For this investigation, a liquid is forced past models representing the four possible combinations of yarns in a woven fabric interstice, and the fluid motion is visualized by using air bubbles, which are detected by means of a suitable light source, as the distinguishing medium. Since both the fluid and the construction material for the models and viewing chamber are translucent and possess the same refractive indices, it is possible to obtain uninterrupted, undistorted visualization of the fluid flow through and past the fabric-like structures. Visual and photographic investigations of the flow are made in various significant planes normal to the fabric-like structures, or parallel to the direction of flow. The resulting photographs are analyzed and interpreted to provide information concerning the effect of fabric construction and variation of Reynold's number on the area available for the passage of fluids through each pore type, or the so-called "effective pore area." It is shown that the four pore types do not behave like geometrically similar orifices, so that for a given diameter/pitch ratio the effective pore

area is not the same in all cases. This area decreases with increasing Reynold's number. Except at very low Reynold's numbers, the effective pore area proves to be less than the actual minimum pore area, but greater than the projected area, with the exception of the plain-weave pore type. Assuming a minimum cross-sectional pore area, as determined by graphical analysis, it is shown that the effective pore area/minimum pore area ratio is almost a constant for all four pore types of the models tested at a Reynold's number of 400.

Authors' Abstract

Gas-Mixture Viscosities

Buddenberg, J. W. and Wilke, C. R. VISCOSITIES OF SOME MIXED GASES. *J. Phys. Colloid Chem.* 55, 1491-1498 (1951) December.

Viscosity measurements were made on some binary and ternary gas mixtures at atmospheric pressure and 25.0°C. The systems studied were hydrogen-Freon, hydrogen-carbon dioxide, hydrogen-neon, freon-nitrogen, and freon-carbon dioxide. An empirical equation was applied to the data for the estimation of the viscosities of binary gas mixtures. This equation contains only one arbitrary constant depending on the gases, temperature and pressure. Viscosities and densities of the pure components must also be known. The measurements were made in a small capillary tube using the classical Rankine apparatus.

N. L. Carr

Latent Heat of Vaporization

O'Hara, J. B. and Fahien, R. W. LATENT HEATS OF VAPORIZATION OF SOME ORGANIC COMPOUNDS. *Ind. Eng. Chem.* 43, 2924-25, (1951) December.

Latent heats of vaporization of 88 organic compounds from a pressure of 1 mm to the critical pressure are presented in tabular form. The Clapeyron equation, combined with empirical equations relating vapor pressure with temperature (Antoine equation), and the specific volume of saturated vapor and liquid with temperature and pressure (Haggenmacher equation) was used to calculate these values. Values of 12 out of 88 compounds were checked with literature data. From this comparison it is felt that average deviation for all compounds will be less than 4% and in most cases close to 1%.

D. C. Gami

Phase Equilibria

Culberson, O. L. and McKetta, J. J., Jr. PHASE EQUILIBRIA IN HYDROCARBON-WATER SYSTEMS. IV—VAPOR-LIQUID EQUILIBRIUM CONSTANTS IN THE METHANE-WATER AND ETHANE-WATER SYSTEMS. *J. Petroleum Technology* 3, 297-300 (1951) November.

The equilibrium constants for methane-water, and for ethane-water have been calculated from experimental data for the two binary systems. These constants are for the two-phase systems for the temperature range of 100° to 340°F and the pressure range of 200 to 10,000 psia.

D. C. Gami

Reaction Rates

Platt, S. M. and Farrar, G. L. INTRODUCTION TO CHEMICAL REACTION CALCULATIONS. PART II and PART III: *Petroleum Refiner* 30, 147-152, October; 137-142 (1951) December.

A simple and concise treatment is given of the methods of solution of homogeneous reaction rate equations for typical systems at constant as well as variable volume. A short treatment of heterogeneous kinetics is also given.

H. R. Linden

Potter, C. and Baron, S. KINETICS OF THE CATALYTIC FORMATION OF PHOSGENE. *Chem. Eng. Progress* 47, 473-84 (1951) September.

The catalytic formation of phosgene from carbon monoxide and chlorine is described using a charcoal catalyst in a flow system with a differential bed. Temperature and concentration dependent rate equations for the reaction with and without nitrogen are indicated. The paper presents a detailed account of the method of examining the kinetics of the reaction.

S. Katz

Shape Factor in Absorption

Danckwerts, P. V. ABSORPTION BY SIMULTANEOUS DIFFUSION AND CHEMICAL REACTION INTO PARTICLES OF VARIOUS SHAPES AND INTO FALLING DROPS. *Trans. Faraday Soc.* (British) 47, 1014-1023 (1951) September.

Solutions of the differential equation applying to the absorption of a substance into an ab-

sorbent with simultaneous diffusion and chemical reaction occurring in the absorbent are presented for various shapes. The solution is obtained by transformation of the expressions for diffusion without reaction. The cases considered are the sphere, parallelopiped, cylinder and semi-infinite absorbent. The special case of absorption into a falling drop with internal circulation is also treated. O. T. Bloomer

Thermal Conductivity

Burr, A. C. A RADIAL HEAT FLOW APPARATUS FOR THE DETERMINATION OF THERMAL CONDUCTIVITY. *Can. J. Technology* 29, 451-457, (1951) November.

The author describes an apparatus for use in determining the thermal conductivity of relatively poor conducting solids. The use of complicated guard heaters to prevent unwanted heat loss is not necessary as it is in the rod method of conductivity measurement. The difficulty securing good thermal contacts between the heat source and sample is much less than in the slab method of measurement. A column of five rings of the sample material faced top and bottom with end guard heaters are stacked up with the rod heat source as their axis. Only the center ring is used for measurement and the temperature gradient is obtained from temperatures measured at different radii in the test section. The whole assembly is placed in an evacuated chamber to further reduce anomalous heat losses.

R. T. Ellington

Thermodynamic Properties

Kobe, K. A. and Harrison, R. H. THERMOCHEMISTRY FOR THE PETROCHEMICAL INDUSTRY. PART 18. THE CHLOROETHENES. *Petroleum Refiner* 30, 151-154 (1951) November.

The thermodynamical properties of various chloroethene compounds are tabulated in this article. This is eighteenth in a series, and as previously, contains tables on heat capacities, free energies of formation, heats of formation, heats of combustion, molar enthalpies, and empirical heat capacities equations for temperatures ranging from 32 to 2200°F.

S. Mori

Othmer, D. F. and Gilmont, R. CORRELATING PHYSICAL AND THERMODYNAMIC PROPERTIES. PART II. *Petroleum Refiner* 31, 107-117 (1952) January.

A description of methods for the correlation of physical chemical data based on the comparison of the properties of one substance with those of a reference substance at comparable conditions is given. [See *Gas Abs*, 8, 1, 16 (1952) January] H. R. Linden

Vacuum Physics

Blears, J. APPLICATION OF THE MASS SPECTROMETER OF HIGH VACUUM PROBLEMS. *Vacuum Physics; Suppl. 1, J. Sci. Instruments* (British) 28, 36-42 (1951) July.

The potentialities of the mass spectrometer in studies of high vacuum problems are illustrated by descriptions of analyses of residual gases during initial evacuation, during baking and at the ultimate pressure. Surface exchange and synthesis products are considered, and it is concluded that mass spectrometry can solve many problems where it is difficult to distinguish between extraneous effects and real changes of pressure, or gas composition.

Author's Abstract

Goddard, D. R. MODERN VACUUM PUMPS. *Vacuum Physics; Suppl. 1, J. Sci. Instruments* (British) 28, 1-7 (1951) July.

The two distinct classes of pump, the mechanical and the vapor pump, are discussed in a general rather than a detailed theoretical manner with a view to examing the factors influencing performance and the more important design features. The different types of rotary pump are compared and their performance examined in relation to the requirements of capacity, ultimate pressure and the pumping of condensable vapors. The mechanism of vapor pumps is discussed in relation to the design of ejectors and diffusion-condensation pumps. A comparison of oil and mercury pumps is made and the requirements of capacity, ultimate pressure and backing pressure characteristics discussed.

Authors' Abstract

Millen, T. S. THE DESIGN OF INDUSTRIAL VACUUM SYSTEMS. *Vacuum Physics; Suppl. 1, J. Sci. Instruments* (British) 28, 7-9 (1951) July.

After outlining the laws governing the flow of gases at low pressures and their relation to the performance of individual components, the author proceeds to discuss a trial design. The information required is discussed and the factors which influence the final choice of components are dealt with in some detail with special reference to the basic features and the influence of operating methods and conditions on the design. Systems of control are described and an indication is given of the methods by which automatic protection can be applied.

Author's Abstract

Steckelmacher, W. REVIEW OF VACUUM GAUGES. *Vacuum Physics; Suppl. 1, J. Sci. Instruments* (British) 28, 10-19 (1951) July.

A short account is given of methods for measuring pressures below 10 mm of mercury and of the limitations of conventional gauges for accurate measurement. The applications of gauges to industrial processes and their use as protective devices are discussed.

Author's Abstract

The following articles, the abstracts for which appear on the pages indicated, are also called to your attention:

Eduljee, H. E. PRESSURE-VOLUME TEMPERATURE RELATIONS IN LIQUIDS: PART I. COMPRESSION OF *N*-HEXANE, *N*-HEPTANE, *N*-OCTANE AND THEIR BINARY MIXTURES. p 29

Jewell, R. C. BEHAVIOR OF PLATINUM/PLATINUM-RHODIUM THERMOCOUPLES AT HIGH TEMPERATURES. p. 43

Newitt, D. M. P-V-T RELATIONS IN LIQUIDS: PART II. THE COMPRESSION ISOTHERMS OF SOME ORGANIC LIQUIDS UP TO 1000 ATM., AND OF AQUEOUS AND NON-AQUEOUS BINARY MIXTURES. p. 29

Sledjeski, E. W. ISOBARIC HEAT CAPACITY OF METHANE. p. 30

White, D. CRITICAL TEMPERATURE AND CRITICAL PRESSURE OF NITROGEN. p. 30

9. ORGANIC CHEMISTRY

Acetylene Manufacture

Robinson, S. P. (assigned to Phillips Petroleum Co.) MANUFACTURE OF ACETYLENE. U.S. 2,572,664 (1951) October 23.

The patent claims a method of producing acetylene in yields of 10% from natural gas or suitable hydrocarbon mixture, by heating pebbles to about 2000°F, passing gas through the pebbles, the gas reaching a temperature of about 2000°F. Steam formed by combustion of $H_2 + O_2$ at a temperature of 4000°F aspirates the 2000°F natural gas into a reactor in which the residence time amounts to about 0.005 seconds. The gas is quenched and the products are removed. H. A. Dirksen

Aldehyde Synthesis

Hagemeyer, H. J., Jr. (assigned to Eastman Kodak Co.) PROCESSES FOR THE PRODUCTION OF OXYGENATED COMPOUNDS. U.S. 2,576,113 (1951) November 27.

A continuous process for producing lower weight aliphatic aldehydes is claimed, using an aliphatic olefin with carbon monoxide and hydrogen under suitable conditions of pressure, temperature and catalyst. W. J. Pleticka

Aromatics

Kaufman, M. and Williams, A. F. ACENAPHTHYLENE: ITS POLYMERS AND COPOLYMERS. *J. Applied Chem.* (British) 1, 489-502 (1951) November.

Details of the laboratory and semi-technical-scale preparation of acenaphthylene by the vapor-phase dehydrogenation of acenaphthene are given. Polymerization of acenaphthylene is discussed together with some of the properties of the plasticized polymer. Copolymers with styrene have been studied in their preparation by bulk, bead and emulsion processes and some of their properties have been related to composition and mode of polymerization. The availability and economics of the monomer are considered briefly. Author's Abstract

Aromatics Recovery

Anderson, J. R. (assigned to Koppers Co., Inc.) PURIFICATION OF COKE OVEN BENZENE. U.S. 2,576,092 (1951) November 27.

The invention claims the removal from distilled coke-oven benzene of the high boiling unsaturated impurities, by distilling a two-phase mixture of the benzene with 0.5 to 1.5 parts of acetone and 0.05 to 0.15 parts of water by volume. The acetone, water and impurities are removed as overhead. O. P. Brysch

Lipkin, M. R. (assigned to Sun Oil Company) PROCESS FOR SEPARATING HYDROCARBON FRACTIONS CONTAINING AROMATICS. U.S. 2,576,525 (1951) November 27.

A cyclic process is described for the recovery of aromatics from mixtures of liquid hydrocarbons by successive contacts of a silica gel adsorbent with high and low boiling hydrocarbon mixtures.
H. R. Linden

Butadiene Recovery

Gollmar, H. A. (assigned to Koppers Co., Inc.) PROCESS FOR THE RECOVERY OF BUTADIENE FROM CYCLOHEXANE PYROLATE. U.S. 2,575,341 (1951) November 20.

A process for the selective absorption of butadiene in hydrocarbon pyrolysis products using a mixture of cyclohexane and a lesser amount of benzene as scrubbing medium.
H. R. Linden

Carbazole Recovery

de Bruijn, P. H. (assigned to De Directie van de Staatsmijnen, Netherlands) PROCESS FOR RECOVERY OF CARBAZOLE. U.S. 2,575,314 (1951) November 13.

A process is described which eliminates a step from the conventional carbazole recovery process, and produces a product of high purity and with improved physical characteristics.
D. V. Kniebes

Ethylene Chemicals

Kuhn, W. E. and Hutcheson, J. W. ETHYLENE PETROCHEMICALS TODAY AND TOMORROW: OPTIMISM AND CAUTION. *Petroleum Processing* **6**, 1101-1111 (1951) October: 1236-1243 (1951) November.

These papers stress the rapid growth in use of ethylene in the chemical industry. From 1940 when less than 100 million pounds were used, ethylene consumption increased to 1,536 million pounds in 1950. The projected usage of ethylene in 1962 is 3,946 million pounds. The production of the seven major volume chemicals made from ethylene is discussed for the entire 1940 to 1962 period. The article emphasizes the difficulties involved in entering this apparently profitable field, stressing the economic necessity of large capacity and the difference in outlook between chemical and petroleum production.
C. A. Hall

Ethylene Recovery

Sherwood, P. W. PRODUCTION OF ETHYLENE FROM PETROLEUM SOURCES. *Petroleum Refiner* **30**, 157-160 (1951) November.

This article, part II of a series, covers the application of laboratory data to commercial operating conditions. Conventional tubular cracking furnaces utilize petroleum feeds ranging from ethane to gas oil but require high operating temperatures. Thermofor pyrolysis and partial combustion processes circumvent this difficulty. Considerable operating and design data illustrate the relative merits of the three processes. [See also *Gas Abs* **7**, 290 (1951) Decemesses. [See also *Gas Abs.* **7**, 290 (1951) December.] C. A. Hall

Hydrogenation

Jones, D. G. and Taylor, A. W. DIRECTIVE CATALYTIC HYDROGENATION OF ORGANIC COMPOUNDS. *Chem. Ind.* (British) **49**, 1075-1077 (1951) December 8.

This article tells in detail how (a) changes in catalyst, (b) additions to the catalyst, (c) the temperature and rate of reaction can influence the catalytic hydrogenation reaction of furan and related compounds. C. A. Hall

Pyridine Synthesis

PYRIDINES TEMPT NEW PRODUCERS. *Chem. Engr.* **58**, 228-230 (1951) November.

New synthetic processes for the manufacture of pyridines, based ultimately on coal and pe-

troleum, will soon break the coal-tar bottleneck. 2-Methyl-5-ethyl pyridine, from acetaldehyde and ammonia, is used in the synthesis of niacin and niacinamide, and its dehydrogenation product in the synthetic fiber industry. Among new producers of pyridines is Phillips Chemical Co., which is building a $2 million methyl ethyl pyridine unit. Production of pyridines could stimulate interest for coal-tar people.

J. M. Spanknebell

The following article, the abstract for which appears on the page indicated, is also called to your attention:

O'Hara, J. B. LATENT HEATS OF VAPORIZATION OF SOME ORGANIC COMPOUNDS. p. 36

10. CHEMICAL ENGINEERING

Absorber Design

Gilmore, F. E. and Bauer, R. D. GAS PLANTS FOR CATALYTIC CRACKING UNITS. *Petroleum Engr.* 23, C26-C36 (1951) December; *Oil Gas J.* 50, 84-95, 119, (1951) November 29.

The article discusses and gives examples of alterations that can and have been made in the recovery of hydrocarbon from a gas in existing absorbers by increasing the absorption factor. The factors contributing to high extraction are increase in pressure, increase in molal ratio of absorption oil to gas, lower temperature of absorption and increase in theoretical trays. The absorption factor is defined by the equation. $A = L/KV$. A = absorption factor, L = moles per unit time of downflow oil, V = moles per unit time of upflow vapors; K = equilibrium constant of component considered.

H. A. Dirksen

Cooling Towers

Degler, H. E. SELECTION AND OPERATION OF WATER-COOLING TOWERS AND AIR-COOLED HEAT EXCHANGERS. *Petroleum Refiner* 30, 145-150 (1951) November.

A comparison of water cooling towers and air cooler heat exchangers is presented. The predominant method today is the use of the water cooling towers. However in high-level heat transfer and in situations where water is scarce or polluted or unduly corrosive the air-cooled design has distinct advantages. Cost comparisons and operation and maintenance details are given for a similar installation of each type. The main conclusion is that when cooling is to be done at a high temperature level, air-cooled heat exchangers should be considered. [See also *Gas Abs.* 7, 260 (1951) November; 8, 17 (1952) January].

W. G. Bair

Fixed-Bed Properties

Campbell, J. M. and Huntington, R. L. HEAT TRANSFER AND PRESSURE DROP IN FIXED BEDS OF SPHERICAL AND CYLINDRICAL SOLIDS. PART I. PRESSURE DROP AND PACKED BED CHARACTERISTICS. *Petroleum Refiner* 30, 127-33 (1951) December.

Experimental data in the turbulent range on pressure drop through fixed beds of commercial grade solids were used to evaluate empirical constants in a generalized pressure drop equation based on a modified Reynolds Number. Relationships for the fraction of void space in the bed and the particle surface area were also determined from the data. C. von Fredersdorff

Flow Measurement

Fitch, E. C., Jr., and Wyatt, H. M. EFFECT OF TRANSIENT PRESSURES ON FLOW METERING. *World Oil* 134, 218, 220 (1952) January.

Pulsating pressure surges cause flow measurements to record higher values than the true flow through a pipe line. The authors advance a simple theory and mathematical means of calculating the percent of error.

Authors' Abstract

Fluidizing Reactor

Rollman, W. F. (assigned to Standard Oil Development Co.) PROCESS AND APPARATUS FOR CONTACTING FLUID SOLIDS WITH GASES. U.S. 2,575,297 (1951) November 13.

The patent claims a design of fluidizing reactor that will lower attrition of catalysts, ensure complete fluidization, and prevent a fixed bed resting on a screen or grid from channelling in the bottom of the reactor. The reactor is of conventional design, the difference being that catalyst is continually being drawn off through vertical tubes attached to the bottom of the vertical section of the reactor. The gas is

introduced through slanted tubes entering the inverted cone bottom, where it rises and entrains catalyst from the vertical tubes.

H. A. Dirksen

Handling Pulverized Materials

Silver, F. PROBLEMS ARISING IN STORAGE AND HANDLING OF PULVERIZED MATERIALS. *Engineers' Digest* (British) **12**, 331-333, 344 (1951) October.

The author discusses the need for a new approach to the problems of flow of pulverized materials. Perfect fluid laws cannot be applied and the angle of repose concept is not adequate. Because of the erratic behaviour of imperfect fluids the determination and use of thixotropic curves is suggested, the term thixotropic applying to any imperfect fluid that increases its yield-point with time. In addition consideration should be given to another type of flow, plug flow, which takes place where the shear is less than the yield value as in the center of a streamline flow region. An investigation of flow problems in grain handling showed that pressures in grain bins do not follow laws of perfect fluids, the static pressures increasing more slowly as the volume of grain gets higher until at a height of 2½ diameters they stop increasing. The use of vibration and air in a bin to aid in feeding is mentioned.

E. J. Pyrcioch

Nitric Oxide Recovery

Daniels, F., Hendrickson, W. G., and Foster, E. G. (assigned to Wisconsin Alumni Research Foundation) NITRIC OXIDE RECOVERY SYSTEM. U.S. 2,578,674 (1951) December 18.

The invention proposes a method of recovery of nitrogen dioxide from an N_2, O_2, NO_2 mixture, by first drying and cooling the gases, then adsorbing the NO_2 on silicon dioxide in a moving bed, then desorbing the NO_2 by a *heated* stream of NO_2.

O P. Brysch

Nitrogen Purification

Shapleigh, J. H. (assigned to Hercules Powder Company) GAS PURIFICATION. U.S. 2,578,490 (1951) December 11.

A system for purifying nitrogen suitable for the production of ammonia is claimed.

W. J. Pleticka

Pilot Plant Design

Wedner, B. M., Horne, W. A., Joyce, T. P. PILOT PLANT DESIGN. *Petroleum Eng.*, **23**, C11-C16 (1951) December.

This is an excellent discussion of high-pressure, high-temperature bench-scale reactors. Materials of construction and construction features such as closures are evaluated on the basis of actual operating experience.

W. G. Bair

Pipeline Technology

Shipley, J. R. DEVELOPMENTS IN PRODUCTS PIPE LINE TECHNOLOGY. *Petroleum Eng.* **23**, D11-D16 (1951) December. *Pipe Line News* **23**, 31-35 (1951) December.

This paper summarizes information presented by the API Subcommittee on Products Pipe-Line Technology. Various items such as fire-fighting systems, pipe line filters, meter installations, batch cutting, electrical controls, and conservation are discussed.

B. E. Hunt

Pressure Vessel Design

Wolosewick, F. E. SUPPORTS FOR VERTICAL PRESSURE VESSELS. PART IV. *Petroleum Refiner* **30**, 151-53 (1951) December.

Stresses in vessel supports due to temperature gradients are estimated by utilizing the concept of a beam on an elastic foundation. [See also *Gas Abs.* **7**, 292, 293 (1951) December].

C. von Fredersdorff

Waste-Heat Boilers

Sherwood, P. W. SAVE THOSE BTU'S WITH WASTE-HEAT BOILERS. *Petroleum Processing* **6**, 1250-1253 (1951) November.

A discussion of waste-heat boilers and their application to the petroleum industry is given. The author contends that almost all refinery operations (especially thermal cracking) involve sufficiently large amounts of high heat-content flue gases as to warrant the installation of waste-heat boilers. Highly simplified theoretical equations are presented which will serve as a basis for deciding if a given operation is suitable for waste-heat recovery.

W. G. Bair

The following articles, the abstracts for which appear on the pages indicated, are also called to your attention:

Kobe, K. A. THERMOCHEMISTRY FOR THE PETROCHEMICAL INDUSTRY. PART 18. THE CHLOROETHENES. p. 37

Othmer, D. F. CORRELATING PHYSICAL AND THERMODYNAMIC PROPERTIES. p. 37

Rose, A. DIGITAL COMPUTERS FOR TRIAL AND ERROR CALCULATIONS OF DISTILLATION DESIGN. p. 42

11. PROCESS EQUIPMENT AND INSTRUMENTATION

Computer Applications

Rose, A., Lombardo, R. J. and Williams, T. J. SELECTIVE ADSORPTION COMPUTATIONS WITH DIGITAL COMPUTERS. *Ind. Eng. Chem.* **43**, 2454-71 (1951) November.

A discussion of existing methods for the prediction of composition during selective adsorption processes for nonideal and multicompotent cases is given. The complexity and tedium of this work is indicated, and methods of designing stepwise procedures adaptable to IBM computers are described and illustrated. S. Katz

Rose, A., Williams, T. J. and Kahn, H. A. DIGITAL COMPUTERS FOR TRIAL AND ERROR CALCULATIONS OF DISTILLATION DESIGN. *Ind. Eng. Chem.* **43**, 2502-2506 (1951) November.

The use of the IBM card-programed electronic digital calculator for the trial and error computations normally encountered in distillation problems is discussed. An example problem is used to illustrate the details of operating procedure. B. E. Hunt

Dust Removal

Schneible, C. B., and Lundy, A. S. GAS TREATING APPARATUS AND METHOD. U.S. 2,579,401 (1951) December 18.

The invention relates to a gas cleaning apparatus which embodies a gravity separation of dirty gases. This separation sends the heavy dirty portion to a scrubbing tower and the clean portion goes out of the system. W. G. Bair

Flow Measurement

Jacobson, E. W. POSITIVE DISPLACEMENT METERS. *Petroleum Eng.* **23**, D46-D54 (1951) November.

Designs are available and procedures well enough established so that PD meters can measure accurately liquid hydrocarbons. This paper discusses the basic standard of measurement, measuring accuracy, the fundamental concepts of positive displacement meter theory, and presents the more successful designs of meters.
Author's Abstract

Flow Meters

Bean, H. S. DIFFERENTIAL HEAD METERS USEFUL TO THE PETROLEUM INDUSTRY. *Petroleum Eng.* **23**, C15-C20 (1951) November.

A discussion of differential head meters applied to fluid flow measurement in the petroleum industry is given. 10 references are included.
W. G. Bair

Shaver, J. R. RING BALANCE METERS. *Instruments* **24**, 1507 (1951) December.

Some of the operating principles, design and construction features, and typical applications of "Hagan Ring Balance Meters" are discussed.
B. E. Hunt

Hot Gas Valve

Johnson, F. H. (assigned to United States Steel Co.) HIGH-TEMPERATURE GAS VALVE. U.S. 2,575,875 (1951) November 20.

A water-cooled, refractory-lined high-temperature gas valve is described, comprising an annular conical disc closure coupled to an annular stem which serves both as cooling water inlet and outlet. C. von Fredersdorff

Infrared Gas Detector

Pfund, A. H. (assigned to United States of America) MANOMETRIC GAS DETECTOR. U.S. 2,573,870 (1951) November 6.

A manometric gas detector cell is described which is sensitive to the volumetric expansion of a gas which is being subjected to infrared radiation. This cell can be used as a detector in an apparatus which analyzes gases having infrared absorption bands. D. V. Kniebes

Oxygen Recorder

Griffith, R. H. MAGNETIC OXYGEN RECORDER FOR AUTOMATIC CONTROL OF CATALYTIC PURIFICATION. *Gas World* (British) **134**, 522-525 (1951) December 8.

Among the normal components of coal gas, oxygen is outstanding in being strongly magnetic. This property is the basis of an instrument that has been designed to record the oxygen content of a gas in the range zero to 2 per cent by volume. This instrument has now been used, in conjunction with a pneumatic valve mechanism, for the automatic control of a catalytic plant in which organic sulphur compounds are removed from coal gas. Author's Abstract

Pebble Heaters

Quigg, D. J. and Alleman, C. E. (assigned to Phillips Petroleum Co.) METHOD AND APPARATUS FOR CONVERTING AND QUENCHING HYDROCARBONS. U.S. 2,572,758 (1951) October 23.

This invention relates to a pebble heat exchanger apparatus for hydrocarbon conversion wherein the pebbles are also used for quenching the reaction products. The apparatus is adaptable to cracking light hydrocarbons and residual hydrocarbon fractions. It is claimed that accumulation of carbon in the reaction chamber is substantially prevented.

E. J. Pyrcioch

Process Analog Device

Johnson, E. F., Jr. A PNEUMATIC PROCESS ANALOG FOR INSTRUCTION AND RESEARCH. *Ind. Eng. Chem.* **43**, 2708 (1951) December.

A pneumatic process analog which has been used for instruction and research is described. The analog permits (a) the illustration of various types of control, (b) the comparison of transients with mathematical derivations, and (c) the design of optimum process control installations. B. E. Hunt

Pyrometry

Jewell, R. C. and Knowles, E. G. BEHAVIOR OF PLATINUM/PLATINUM-RHODIUM THERMOCOUPLES AT HIGH TEMPERATURES. *J. Sci. Instruments* (British) **28**, 353 (1951) November.

An examination of a platinum-13% rhodium platinum thermocouple after operation between 1500 and 1600° C disclosed a preferential volatilization of rhodium.

S. Katz

Ziegler, G. W., Jr., Bollinger, L. E., Speiser, R., and Johnston, H. L. NOTES ON HIGH VACUUM, HIGH TEMPERATURE TECHNIQUE IN INDUCTION HEATING. *Rev. Sci. Instruments* **22**, 842, 843 (1951) November.

The major part of the stray A.C. current induced into a thermocouple inserted in an induction-type furnace can be eliminated by suitable metal shielding. However a small exposure to these currents is unavoidable, and can be eliminated by using a *delta* filter. The *delta* filter consists of three silvered mica condensers hooked up in *delta* to the two thermocouple leads and ground. S. Mori

The following articles, the abstracts for which appear on the pages indicated, are also called to your attention:

Goddard, D. R. MODERN VACUUM PUMPS. p. 37
Sharpe, J. W. THE ELECTRON MICROSCOPE AND ITS INDUSTRIAL APPLICATION. p. 34

12. MATERIALS OF CONSTRUCTION

Cathodic Protection

Ewing, S. P. POTENTIAL MEASUREMENTS FOR DETERMINING CATHODIC PROTECTION REQUIREMENTS. *Corrosion* **7**, 410-418 (1951) December.

The minimum potential between pipe and soil which is necessary for adequate cathodic protection is not a constant voltage as previously believed, but varies with environment, season, rainfall and protective coating on metal surface. Knowledge of the minimum voltage would cut the cost of cathodic protection. This article describes a method of procedure of obtaining this potential at different localities.

S. Mori

Corrosion

McFaddin, D. E. H_2S AND CO_2 CORROSION OF CARBON STEEL IN NATURAL-GAS PROCESSING PLANTS. *Oil Gas J.* **50**, 97, 98 (1951) December 13.

General conclusions based upon case histories are given concerning H_2S and CO_2 corrosion of carbon steel. It is generally observed that water must be present for corrosion to occur. A more severe corrosion will occur if oxygen is also present. B. E. Hunt

Parker, M. E. CORROSION AND ITS CONTROL. PART 39. LABORATORY CORROSION TESTS. *Oil Gas J.* **50**, 109 (1951) December 13.

The use of laboratory tests as a means of selecting suitable materials for more complete tests is discussed. Various critical factors in laboratory tests are discussed.

B. E. Hunt

Parker, M. E. CORROSION AND ITS CONTROL. PART 40. CORROSION TESTS ON OPERATING EQUIPMENT. *Oil Gas J.* **50**, 86 (1951) December 27.

The presence of active corrosion can often be inferred by the observation of auxiliary effects. These effects may be roughly classified as mechanical (leaks, pressure drops), chemical (composition of fluids) and electrical (potentials or current flow).

B. E. Hunt

Foundation Design

Bird, A. G. REFERENCES AND EXPERIENCES RELATIVE TO GASWORKS FOUNDATIONS. *Gas J.* (British) **268**, 549-552 (1951) November 28.

Important considerations are given to soil mechanics and concrete construction in the design and location of foundation piles.

C. von Fredersdorff

Heat-Reflecting Paints

HEAT-REFLECTING PAINTS. *Coke and Gas* (British) **13**, 441, 443 (1951) December.

Laboratory results which indicated the reflectivity or emissivity of various types of paints and pigments are reported. B. E. Hunt

Pipe Welding

Auler, E. P. APPLICATION OF OXY-ACETYLENE PROCESSES IN PIPE FABRICATION. *Ind. & Welding* **24**, 34, 36 78-80 (1951) December.

Oxy-acetylene torches are used in the preparation of outlets in header pipes and of plate edges, and in the gouging of weld defects. A principal use of the torches is in preheating metals prior to welding or cutting, and in stress relieving after welding. B. E. Hunt

Refractories

A PROTECTIVE COATING FOR REFRACTORIES. *Ceramics* **32**, 422-428 (1951) October.

The elimination of surface pores of refractory linings by application of coatings offers considerable advantages in prolonging the refractory life particularly in applications requiring resistance to thermal and mechanical spalling and chemical attack. Slag attack from fused salt constituents in fuel ash, as for example sodium sulfate in fuel oil, can combine with the silica content of refractory brick to form eutectics of very low melting point. Slag attack may be reduced by a combination of a refractory coating on an acid refractory (silica) for acid slags or on a basic refractory (magnesia or lime) for basic slags. Recommended coating materials suitable for application by brush are mentioned in the article. C. von Fredersdorff

13. NEW BOOKS

Applied Fluid Flow

The Institute of Physics. SOME ASPECTS OF FLUID FLOW. London: Arnold & Co., 1951.

This book covers a number of applications of fluid flow principles to industrial problems such as design of ejectors, flow of fluids through beds of granular materials, sedimentation, mixing of fluids and atomization of liquids. It is a compilation of papers presented as a symposium by the Institute of Physics (British).

J. D. Parent

SERVICE TO READERS

Bibliographies and Literature Searches

The library will prepare bibliographies and make literature searches on a cost basis plus a fixed service charge. A comprehensive statement outlining the problem in detail must be presented with the request.

Photocopies

The library will furnish photostatic or microfilm copies of articles abstracted in GAS ABSTRACTS at cost.

Abstracts on Cards

Copies of any abstract in GAS ABSTRACTS on 5 x 8 cards will be supplied on request.

Periodicals Abstracted for GAS ABSTRACTS

Acta Crystallographica (British)
American Gas Association Monthly
American Gas Journal
American Petroleum Institute Quarterly
American Society for Testing Materials Bulletin
Analytica Chemica Acta (Netherlands)
Analytical Chemistry
Bituminous Coal Research
Blast Furnace and Steel Plant
British Abstracts
British Coal Utilization Research Association Monthly Bulletin
Butane-Propane News
California Oil World
Canadian Chemistry and Process Industries
Canadian Gas Journal
Canadian Journal of Chemistry
Canadian Journal of Physics
Canadian Journal of Technology
Ceramic Age
Chemical Abstracts
Chemical and Engineering News
Chemical Engineering
Chemical Engineering Progress
Chemical Week
Chemical Reviews
Chemistry and Industry (British)
Coal Age
Coal Heat
Coke and Gas (British)
Combustion
Compressed Air
Construction Methods and Equipment
Corrosion
Electronic Engineering (British)
Engineers' Digest (British)
Fuel Abstracts (British)
Fuel (British)
Fueloil and Oil Heat
Gas
Gas Age
Gas and Oil Power (British)
Gas Heat in Industry
Gas Journal (British)
Gas Research Board Publications (British)
Gas Times (British)
Gas World (British)
Heating and Ventilating
Heating, Piping and Air Conditioning
Independent Petroleum Association of America Monthly
Industrial and Engineering Chemistry
Industrial Gas
Industrial Gas (British)
Industrial Heating
Institution of Gas Engineers: Bulletins, Communications and Transactions (British)
Instruments
International Chemical Engineering and Process Industries (British)
Iron Age
Journal des Usines a Gaz (French)
Journal of the American Chemical Society
Journal of Applied Chemistry
Journal of Applied Mechanics
Journal of Applied Physics
Journal of Chemical Education
Journal of Chemical Physics
Journal of the Chemical Society (London)
Journal of Engineering Education
Journal of the Institute of Fuel (British)
Journal of the Institute of Petroleum (British)
Journal of Metals
Journal of the Optical Society of America
Journal of Organic Chemistry
Journal of Petroleum Technology
Journal of Physical and Colloid Chemistry
Journal of Research National Bureau of Standards
Journal of Scientific Instruments (British)
Journal of Southern Research
LP Gas
Materials and Methods
Mechanical Engineering
Mining Engineering
National Fire Protection Association Quarterly
National Gas Bulletin (Australia)
National Petroleum News
Nature (British)
Nucleonics
Official Gazette of the U.S. Patent Office
Oil and Gas Journal
Petroleum (British)
Petroleum Engineer
Petroleum Processing
Petroleum Refiner
Physics Today
Pipe Line News
Power
Power Engineering
Proceedings of the Institute of Radio Engineers
Public Utilities Fortnightly
Refrigerating Engineering
Review of Scientific Instruments
Revista dei Combustibili (Italian)
Science
Southern Power and Industry
Steel
Transactions American Society of Mechanical Engineers
Transactions of the Faraday Society (British)
U.S. Bureau of Mines Bulletins, Information Circulars Reports of Investigations and Technical Papers
World Oil